ITEM 238

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RUBBERIZED EMULSION AGGREGATE SLURRY WITH POLYMER (REAS)

This Item shall govern for the installation of a mixture of rubberized polymer modified emulsion asphalt (RPME) consisting of proportioned and mixed ground tire rubber and polymer, mineral aggregate, and water properly proportioned, mixed, and spread on an asphalt prepared underlying course or existing wearing course in accordance with these specifications and shall conform to the dimensions shown on the plans or as directed by the Engineer. The slurry, when cured, shall bare a homogeneous appearance, fill all cracks, and adhere firmly to the adjacent surface, and have a skid resistance texture.

APPLICABLE SPECIFICATIONS:

Methods, materials, or any specific reference included in this specification shall conform to the following specifications:

AASHTO M 17
ASTM C 88
ASTM C 117
ASTM C 131
ASTM C 136
ASTM D 242
ASTM D 2419

MATERIALS:

Aggregate. The aggregate shall consist of sound and durable manufactured sand, slag, crusher fines, crushed stone, or a combination thereof. The aggregate shall be clean and free from vegetable matter, dirt, and other deleterious substances. The aggregate shall have a sand equivalent of not less than 45 percent when tested in accordance with ASTM D 2419. The aggregate shall show a loss of not more than 35 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 12 percent, or the magnesium soundness loss shall not exceed 20 percent after 5 cycles when tested in accordance with ASTM C 88. Aggregate shall be 100 percent crushed. The combined aggregate shall conform to the gradation shown in Table 1 when tested in accordance with ASTM C 136 and ASTM C 117.

Table 1
Gradation of Aggregates

Sieve Size	Percent by Weight Passing Sieve Type II
3/8 in. (9.5 mm)	100
No.4 (4.75 mm)	90 – 100
No.8 (2.36 mm)	65 – 90
No.16 (1.18 mm)	45 – 70
No.30 (600 micro m)	30 – 50
No.50 (300 micro m)	18 – 30
No.100 (150 micro m)	10 – 21
No.200 (75 micro m)	5 – 15
Residual RPME [1] content by percent dry weight of aggregate	14 – 17

[1] RPME – Rubberized polymer modified emulsion

The job mix formula (mix design) shall be run using aggregate within the gradation band shown in Table 1. Once the mix design has been submitted and approved, the aggregate used on the project shall not vary by more than the tolerances shown in Table 2. At no time shall the aggregate used go out of the gradation bands in Table 1.

The aggregate will be accepted at the job location or stockpile. The stockpile will be accepted based on five gradation tests samples in accordance with ASTM D 75. If the average of the five tests is within the gradation tolerances, then the materials will be accepted. If the tests show the materials to

be out of tolerance, the Contractor will be given the choice either to remove the material or blend other aggregates with the stockpile material to bring it into specification. Materials used in blending shall meet the quality tests before blending and shall be blended in a manner to produce a consistent gradation. This may require a new mix design.

Screening shall be required at the project stockpile site if there are any problems created by having oversize materials in the mix.

Precautions shall be taken to prevent segregation of the aggregate in storing and handling. The stockpile shall be kept in areas that drain readily.

Aggregate Tolerance. Once the mix design has been accepted, the aggregate gradation used on the project may vary from the aggregate gradation used in the mix design on each sieve by the percentages shown in Table 2. If the project aggregate fails to remain within this tolerance, the Engineer at the expense of the Contractor will require a new mix design.

Table 2
Aggregate Tolerances

Sieve Size	Percent Tolerance by Weight Passing Sieve
3/8 in. (9.5mm)	+ or – 5%
No. 4 (4.75mm)	+ or – 5%
No. 8 (2.36mm)	+ or – 5%
No. 16 (1.18mm)	+ or – 5%
No. 30 (600 micro m)	+ or – 5%
No. 50 (300 micro m)	+ or – 4%
No. 100 (150 micro m)	+ or – 3%
No. 200 (75 micro m)	+ or – 2%
Residual RPME [1], percent dry weight of aggregate	+ or – 1%

[1] RPME – Rubberized polymer modified emulsion

Mineral Filler. If mineral filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242 and shall be used in the amounts required by the mix design. The mineral filler shall be considered as part of the aggregate.

Rubberized Polymer Modified Emulsion (RPME). The RPME shall be a slow-set or a quick-set type of emulsion as determined by the Engineer. RPME shall contain asphalt, ground tire rubber and polymer modifiers. The RPME shall conform to the following quality requirements:

Viscosity, 25°C (77°F), Brookfield, Model RVT #6 Spindle @ 10 RPM (Centipoises)	2,500 min. 20,000 max
Residue by Evaporation % ASTM D 244	50 min.
Sieve Test % retained on No. 20 screen ASTM D 244	2.0 max. [2]
Weight per Liter (Gallons)	1.0 kg/L (8.33 lbs/gal) min. 1.05 kg/L (8.75 lbs/gal) max.
Penetration of Residue, 25°C (77°F), 100 g. 5 sec. ASTM D 5	20 min. 40 max.
Percent Residue Soluble in Trichloroethylene ASTM D 2042	75 min.

[2] Sieve test of original emulsion is 0.10 max.

Ground Tire Rubber. The material shall be granulated scrap tire rubber free from fabric wires and other contaminants. Rubber shall be dry and free flowing. Calcium carbonate or talc may be added to a maximum of 4 percent by weight of rubber to prevent rubber particles from sticking together. The rubber shall have a specific gravity between 1.15 and 1.20. One hundred percent of the rubberized material shall pass a 1.18 mm (N0. 16) sieve, 95 percent shall pass a 900 um (No. 20) sieve, and a maximum of 2 percent shall pass a 75 um (No. 200) sieve. The RPME shall contain between 66 g/L (0.55 lbs/gal) and 78 g/L (0.65 lbs/gal) of crumb rubber.

Polymer Modifier. Polymer modifier shall be latex, which is added at a minimum of 2 percent polymer solids by weight of the RPME.

Water. All water used in making the slurry shall be potable and free from harmful soluble salts and chemicals.

COMPOSITION:

The Rubberized Emulsion Aggregate Slurry with Polymer shall consist of a mixture of RPME, mineral aggregate, and water.

Job Mix Formula. No slurry seal for payment shall be placed until the Engineer has approved a mix design. The mix design shall be developed by a laboratory with experience in designing slurry seal mixes and a signed copy shall be submitted in writing by the Contractor to the Engineer at least 10 days prior to the start of operations.

The laboratory report (mix design) shall indicate the proportions of aggregates, mineral filler (min. and max.), water (min. and max.) and RPME based on the dry aggregate weight. It shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effects) and shall report the particle charge of the RPME (anionic or cationic). The mix design shall be in effect until modified in writing by the Engineer. Should a change in sources of materials be made, a new mix design shall be established before the new material is used.

The main items of design in Rubberized Emulsion Slurry Seal with Polymer are aggregate gradation, RPME content and consistency of the mixture. The aggregates, RPME, and water should form a creamy-textured slurry that, when spread, will flow ahead of the strike-off squeegee. Proportions shall be based on the mix design.

The Contractor shall submit to the Engineer for approval a complete mix design on the materials proposed for use, prepared and certified by an approved laboratory. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the mix design. The mix design shall be made with the same aggregate and RPME that the Contractor will provide on the project. At a minimum the required tests and values needed are as follows:

TEST	DESCRIPTION	SPECIFICATION
ISSA TB-100	Wet Track Abrasion Loss One Hour Soak	50g/ftz (538 g/mz) Max.

Application Rate. Unless otherwise specified, the slurry seal shall be applied at the application rates shown in Table 3 for that gradation of material used.

Table 3
Application Rates

Pounds of mixture per square yard	10 – 15
Kilograms of mixture per square meter	5.4 – 8.1

The rate of application shall not vary more than ± 2 pounds per square yard (± 1.1 kilograms per square meter).

Test Sections. Test sections shall be placed prior to the start of the slurry seal work in the presence of the Engineer. The test area will be designated by the Engineer and will be located on the existing pavement. The test section shall be made after each machine has been calibrated. Samples of the slurry seal shall be taken and the mix consistency and proportions verified. The rate of application will also be verified. If the test section should prove to be unsatisfactory, the necessary adjustments to the materials, equipment and/or application rates shall be made. Additional test sections, as required, shall be conducted and evaluated for conformance to the specifications. When the test sections do not conform to specification requirements, the treatment shall be removed, and replaced at the contractor's expense. Test section in conformance with the specification will be paid for in accordance with "Basis of Payment" section. Full production shall not begin without the Engineer's approval.

CONSTRUCTION METHODS:

Equipment and Tools. All methods employed in performing the work and all equipment, tools, and machinery used for handling the material and executing any part of the work shall be subject to the approval of the Engineer before the work is started, and whenever found unsatisfactory they shall be changed and improved as required. All equipment, tool, machinery and containers used must be kept clean and maintained in a satisfactory condition. The Contractor shall furnish all equipment, tools, and machinery necessary for the performance of this work.

Slurry Mixing Equipment. The machine shall be specifically designed and manufactured to lay slurry seal. The material shall be mixed by a self-propelled slurry mixing machine of either truck mounted or continuous run design. Either type machine shall be able to accurately deliver and proportion the aggregate, RPME, mineral filler, and water to a revolving mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for materials to maintain an adequate supply to the proportioning controls.

If continuous run equipment is used, the machine shall be equipped to allow the operator to have full control of the forward and reverse speed of the machine during application of the slurry seal, with a self-loading device, with opposite side driver stations, all part of original equipment manufacturer design.

The mixing unit of the mixing chamber shall be capable of thoroughly blending all ingredients. No excessive mixing shall be permitted. The mixing machine shall be equipped with a fines feeder that provides an accurate metering device or method to introduce a predetermined proportion of mineral filler into the mixer at the same time and location that the aggregate is fed into the mixer.

The mixing machine shall be equipped with a water pressure system and fog-type spray bar adequate for complete fogging of the surface with an application of 0.05 to 0.10 gallon per square yard (0.23 to 0.45 liter per square meter) preceding the spreading equipment.

Sufficient machine storage capacity to mix properly and apply a minimum of 5 tons (4 500 kg) of the slurry seal shall be provided. Proportioning devices shall be calibrated prior to placing the slurry seal.

Slurry Spreading Equipment. The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to insure no loss of the mixture at the surface contact point. The rear seal shall act as the final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform mat.

Auxiliary Equipment. Other tools or equipment such as brushes, hand squeegees, hose equipment, tank trucks, water distributors and flushers, power blowers, barricades, etc., shall be provided as required.

Tack Coat and Distributor. Normally a tack coat is not required unless the surface to be covered is extremely dry and raveled or is concrete or brick. If required, the tack coat should consist of one part emulsified asphalt and three parts water. The Engineer shall determine the type of asphalt emulsion used for the tack coat. Pressure distributors used for application of the diluted asphalt emulsion tack coat shall be self-propelled, equipped with pneumatic tires, and capable of uniformly applying 0.05 to 0.15 gallon per square yard (0.23 to 0.68 liter per square meter) of the diluted emulsion over the required width of application. Distributors shall be equipped with tachometers, pressure gages, and volume-measuring devices. The tack coat shall be applied at least 2 hours before the slurry seal but within the same day.

Equipment Calibration. Each slurry seal-mixing unit to be used on the project shall be calibrated in the presence of the Engineer prior to construction. The Engineer may accept previous calibration documentation covering the exact materials to be used provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. No machine will be allowed to work on the project until the calibration has been completed and/or accepted.

Weather Limitations. The REAS shall not be applied if either the pavement or air temperature is

60°F and falling but may be applied when both pavement and air temperatures are 55°F and rising. No REAS shall be applied when there is danger that the finished product will freeze before 24 hours. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

Traffic Control. It shall be the Contractor's responsibility to provide adequate traffic control measures, such as barricades, flagman, cones, etc., to protect the uncured slurry surface from all types of traffic and provide traffic safety in the construction area. Advance warning signs and barricades will be necessary. These measures shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices for Streets and Highways". In the field, the Traffic Engineer will designate street closure and placement of barricades.

Application of REAS. The surface shall be pre-wet by fogging ahead of the slurry spreader box. Water used in pre-wetting the surface shall be applied at such a rate that the entire surface is damp with no apparent flowing water in front of the slurry spreader box. The slurry mixture shall be of the desired consistency when deposited on the surface, and no additional elements shall be added. Total time of mixing shall not exceed 2 minutes. A sufficient amount of slurry shall be carried in all parts of the spreader box at all times so that complete coverage of all surface voids and cracks is obtained. Care shall be taken not to overload the spreader box, which shall be towed at a slow and uniform rate not to exceed 5 miles per hour (8kilometers per hour). No lumping, balling, or unmixed aggregate shall be permitted. No segregation of the emulsion and fines from the coarse aggregate will be permitted. If the coarse aggregate settles to the bottom of the mix, the slurry shall be removed from the pavement surface. A sufficient amount of slurry shall be fed into the box to keep a full supply against the full width of the spreader box. The mixture shall not be permitted to overflow the sides of the spreader box. No breaking of the emulsion will be allowed in the spreader box. The finished surface shall have no more than four (4) tear or drag marks greater then ½ inch (13mm) wide and 4 inches (100mm) long in any 12 foot by 22 foot (25 sq. meter) section. It shall have no tear or drag marks greater than 1 inch (25mm) wide and 3 inches (75mm) long. The finished surface shall have no transverse ripples of ¼ inch (6mm) or more in depth, as measured with a 10 foot (3 meter) straight edge laid upon the surface.

Preparation of Existing Surface. Prior to placing the tack coat and/or REAS, unsatisfactory areas shall be repaired and the surface shall be cleaned of dust, dirt, or other loose foreign matter, grease, oil, excessive rubber accumulation, or any type of objectionable surface film. Any standard cleaning method will be acceptable except that water flushing will not be permitted in areas where considerable cracks are present in the pavement surface. Any painted stripes or markings on the surface of the pavement to be treated shall be removed.

Cracks wider than ¼ inch (6mm) shall be cleaned with compressed air, and sealed with a compatible crack sealer prior to applying the slurry seal. Cracks wider than ¾ inch (19 mm) should be pre-filled and sealed with the slurry mixture prior to surfacing. Cracks that show evidence of vegetation shall be cleaned and treated with an approved herbicide. Crack sealing and herbicide treatment are subsidiary to this item.

Personnel. The contractor shall furnish adequate trained, experienced and qualified personnel to supervise and operate the equipment. The Engineer or the Owners Agent shall have the authority to suspend operations if, in their opinion, such personnel are not present during construction operations.

Adjacent lanes shall be lapped at the edges a minimum of 2 inches (50mm) with a maximum of 4 inches (100mm) to provide complete sealing at the overlap. Construction longitudinal and transverse joints shall be neat and uniform without buildup, uncovered areas, or unsightly appearance. All joints shall have no more than ¼ inch (6mm) difference in elevation when measured across with a 10-foot (3 meter) straight edge.

The fresh slurry seal application shall be protected by barricades and markers and permitted to dry

for 4 to 24 hours, depending on weather conditions. Any damage to uncured slurry shall be repaired at the expense of the Contractor.

In areas where the spreader box cannot be used, the slurry shall be applied by means of a hand squeegee. Upon completion of the work, the seal coat shall have no holes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement. The cured slurry shall have a homogeneous appearance, fill all cracks, adhere firmly to the surface and have skid resistant texture satisfactory to the Engineer. All wasted and unused material and all debris shall be removed from the site prior to final acceptance. Barricades to protect the slurry seal during curing shall not be measured and paid for separately, but will be considered as subsidiary to slurry seal item.

Upon completion of the project, the Contractor shall sweep the finished surface with a conventional power rotary broom, to remove any potential loose material from the surface. The material removed by sweeping shall be disposed of in a manner satisfactory to the Engineer.

Rubberized Polymer Modified Emulsion (Contractor's Responsibility). Samples of the RPME that the Contractor proposes to use, together with a statement as to its source, shall be submitted, and approval shall be obtained before using such material. The Contractor shall submit to the Engineer a manufacturer's certified report for each consignment of the RPME. The manufacturer's certified report shall not be interpreted as a basis for final acceptance. All such reports shall be subject to verification by testing samples of the RPME as received for use on the project.

Notification. It shall be the Contractor's responsibility to notify all residents adjacent to the project of REAS operations and schedules. The City will provide printed notification material to the Contractor for his distribution to the effected citizens.

MEASUREMENT:

This Item will be measured by the square yard [square meter] of Rubberized Emulsion Aggregate Slurry with Polymer (REAS) installed and accepted.

PAYMENT:

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for Rubberized Emulsion Aggregate Slurry with Polymer (REAS). This price shall be full compensation for furnishing and placing materials, surface preparation, and for all labor, tools, equipment and incidentals necessary to complete the work.

BID ITEM:

Item 238.1: Rubberized Emulsion Aggregate Slurry with Polymer (REAS) per square yard [square meter].